

**REMARKS****Status of Claims**

Claims 1-8 are pending, of which claims 1 is independent. Claims 6-8 have been withdrawn. Favorable reconsideration of the application in light of the following comments is respectfully solicited.

**Claim Rejection – 35 U.S.C. § 103**

Claims 1-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Otani et al. (JP62083444). This rejection is traversed for at least the following reasons.

In the Response to Argument section of the present Office Action, the Examiner asserts that the Applicants' argument regarding the size of silicon is not persuasive because nowhere in Otani teaches or implies that the size of silicon alone decreases the abrasion resistance. Applicants respectfully disagree. Although the Examiner asserts that it would be inherently capable to increase the heat resistance by adding silicon, it appears that the Examiner fails provide any factual or technical reasoning for this assertion. Rather, it appears that the Examiner does not fully understand how silicon in an aluminum alloy improves heat resistance (i.e., high-temperature strength) of the alloy, how silicon in an aluminum alloy improves wear resistance of the alloy, and how the size of silicon affects the property of an aluminum alloy.

Applicants respectfully submit that in order for silicon in an aluminum alloy to improve heat resistance of the alloy, it is important to understand how effectively the silicon grains can stop "transition (linear defects)" of the alloy, because such transition causes macroscopic plastic deformation of the alloy. The silicon grains serve to stop such transition by the pinning action. In other words, the silicon grains act like "pins" in the alloy to prevent transition of the alloy. The smaller the size of the pins (i.e. silicon grains) and the higher their density become, the more

effectively the transition of the alloy can be prevented. This is clearly shown in Table 4 of the present specification. Table 4 clearly shows that when the silicon grains are larger than 4  $\mu\text{m}$ , the high-temperature strength (tensile strength at 300°C) is low due to reduced pinning action. In other words, “an average grain diameter of 4  $\mu\text{m}$  or less” is critical to the **high temperature strength** of the alloy.

In this regard, Applicants submit herewith a copy of “Introduction to Metal Physics,” 26th Edition by Honorary Prof. Shigeyasu Koda (1990, Corona, Japan). The following is a English translation of the pertinent part at page 227, lines 2-4:

As a result, dissolved atoms are amassed (segregated) at upper or lower portions of blade-like transition, thereby making transition less movable. This phenomenon is called locking, anchoring or pinning of transition by the dissolved atoms.

Applicants further submit that silicon in an aluminum alloy also increases the **wear resistance**. Silicon increases the wear resistance of the alloy by being exposed to the surface of the alloy and preferentially abraded before the aluminum alloy itself is abraded. In order for the silicon grains to be preferentially abraded before the aluminum alloy itself is abraded, the silicon grains have to remain on the surface of the alloy. For this purpose, it is generally desirable that the silicon grains be as large in size as possible, because the smaller the size of the silicon grains becomes, the more likely the silicon grains are to be elastically pushed into the aluminum alloy and disappear from the surface of the alloy. Thus, in order for the silicon grains to sufficiently improve the wear resistance of the aluminum alloy, their size is generally selected to be sufficiently large in size (e.g., at least 7  $\mu\text{m}$  as shown in JP11-226723) so that as large a number of silicon grains remain on the surface of the aluminum alloy without being pushed into the alloy.

As set forth above, it is general knowledge that the larger size of silicon is preferable for higher strength and it is practically impossible to achieve desired strength of the aluminum alloy without sacrificing the heat resistance. In other words, it is clear that in order to achieve improved abrasion resistance by increasing the size of the silicon grains, the heat resistance has to be sacrificed, and in order to achieve improved heat resistance by reducing the size of the silicon grains, the wear resistance has to be sacrificed. Of course, this is true in Otani. As such, it is clear that although the Examiner asserts that nowhere in Otani teaches or implies the size alone decreases the abrasion resistance, Otani discloses, at least inherently, that the size of silicon alone affects the abrasion resistance of the aluminum alloy.

In Otani, it is clear that silicon is used to improve only the wear resistance of the aluminum alloy, because in Otani, in order to improve the heat resistance of the alloy, iron and nickel are separately added to the alloy. Otani discloses that in order to sufficiently improve the wear resistance of the alloy, the size of the silicon grains in the aluminum alloy has to be 7  $\mu\text{m}$  or over. Based on the foregoing, a person of ordinary skill in the art would not have been motivated to reduce the size of silicon grains used in Otani to 4  $\mu\text{m}$  or less as recited by claim 1, because Otani teaches away from utilizing smaller grain size to improve the wear resistance.

Furthermore, Applicants respectfully submit that, if, arguendo, the size and other factors affected the alloy strength as the Examiner asserts, it would necessarily mean that the size of silicon **alone** is not a result effective variable with respect to the alloy strength. In such a case, as the M.P.E. P. states that only result-effective variables can be optimized (see, M.P.E.P. § 2144.05), Otani's grain size of 7  $\mu\text{m}$  or more could not be optimized to 4  $\mu\text{m}$  or less. Of course, even if the size of silicon alone affects the strength, as set forth above, it is clear that Otani teaches away from utilizing smaller grain size such as 4  $\mu\text{m}$  or less.

Based on the foregoing, Applicants respectfully submit that Otani does not render claim 1 or any claims dependent thereon obvious since Otani teaches away from adjusting the size of silicon grain to 4  $\mu\text{m}$  or less. Accordingly, claims 1-5 are patentable over Otani. Thus, it is requested that the rejection of claims 1-5 be withdrawn.

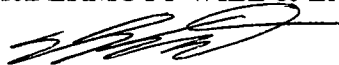
### **Conclusion**

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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